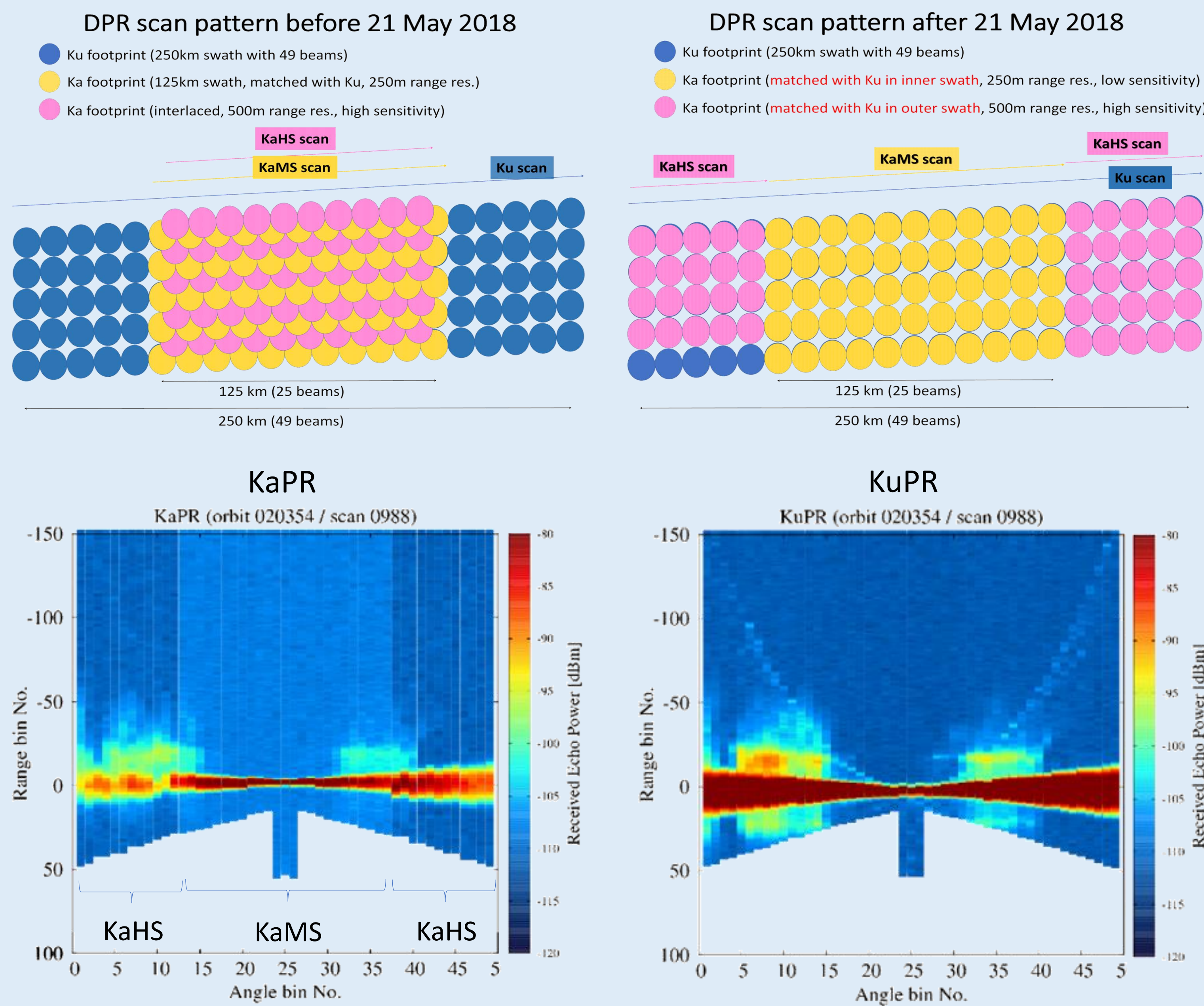# Melting Layer Detection Using Dual-Frequency Ratio (DFR) data from DPR

Toshio Iguchi (NICT) and Yuki Kaneko (JAXA), NASA PMM Science Team Meeting, Phoenix, Arizona, 8-12, October 2018

KaPR scan pattern change

DPR scan pattern before 21 May 2018
- Ku footprint (250km swath with 49 beams)
- Ka footprint (125km swath, matched with Ku, 250m range res.)
- Ka footprint (interlaced, 500m range res., high sensitivity)

DPR scan pattern after 21 May 2018
- Ku footprint (250km swath with 49 beams)
- Ka footprint (matched with Ku in inner swath, 250m range res., low sensitivity)
- Ka footprint (matched with Ku in outer swath, 500m range res., high sensitivity)

KaPR — KaPR (orbit 020354 / scan 0988)

KuPR — KuPR (orbit 020354 / scan 0988)

Degradation of BB detectability at off-nadir angles, especially near scan edges due to the smearing effect.

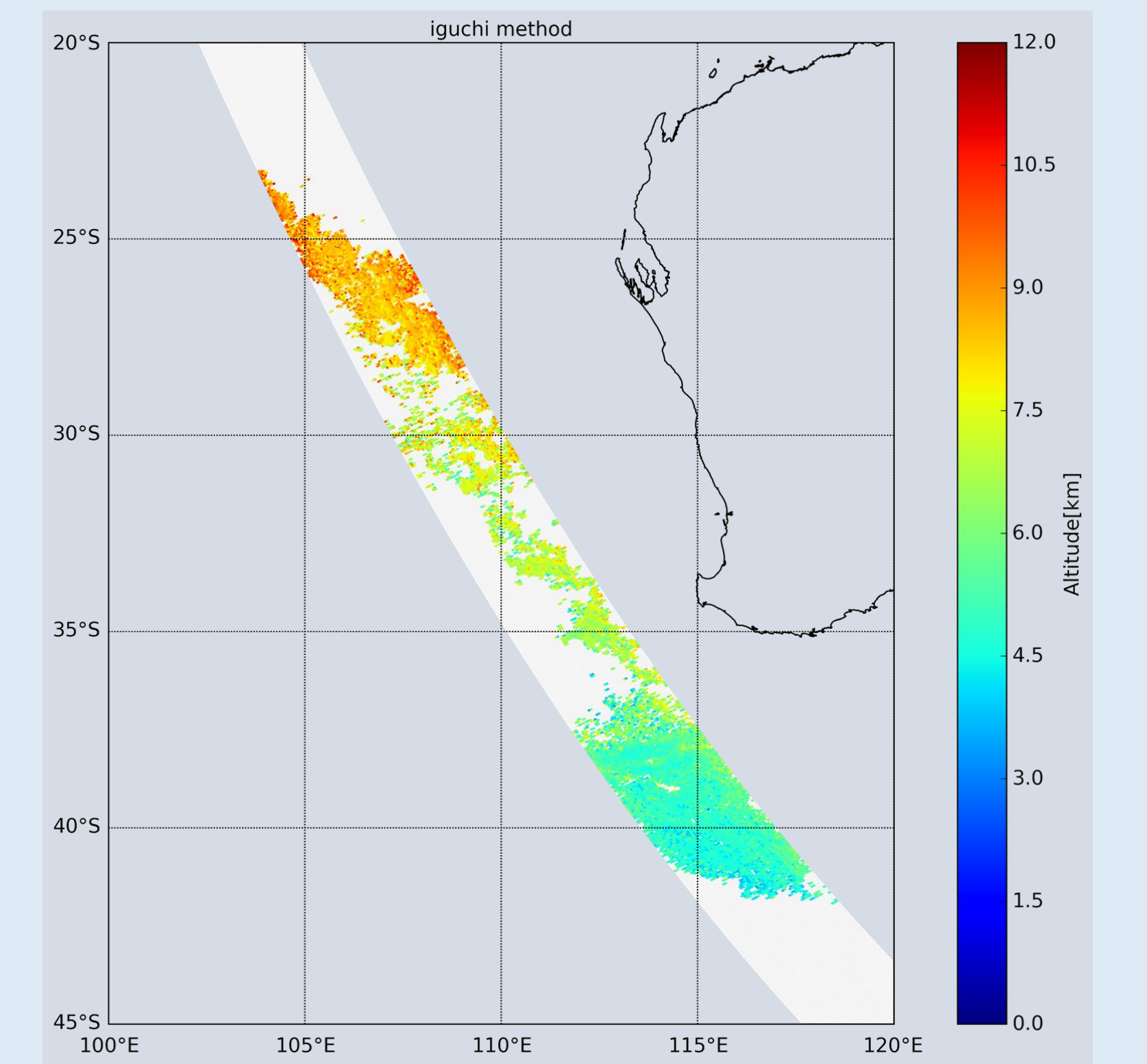Precip. Rate at E surface

BB flag
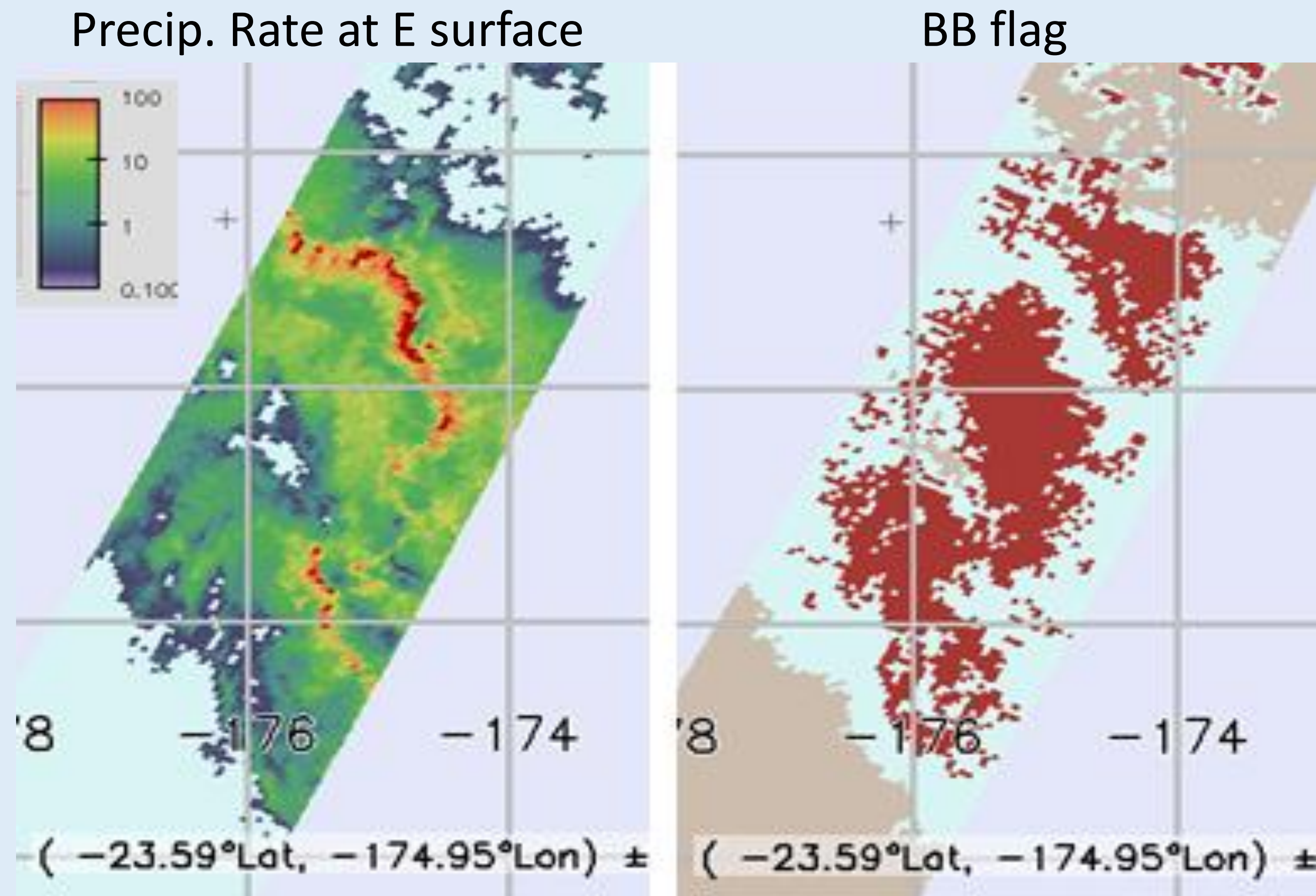
Detection of a melting layer and its top height
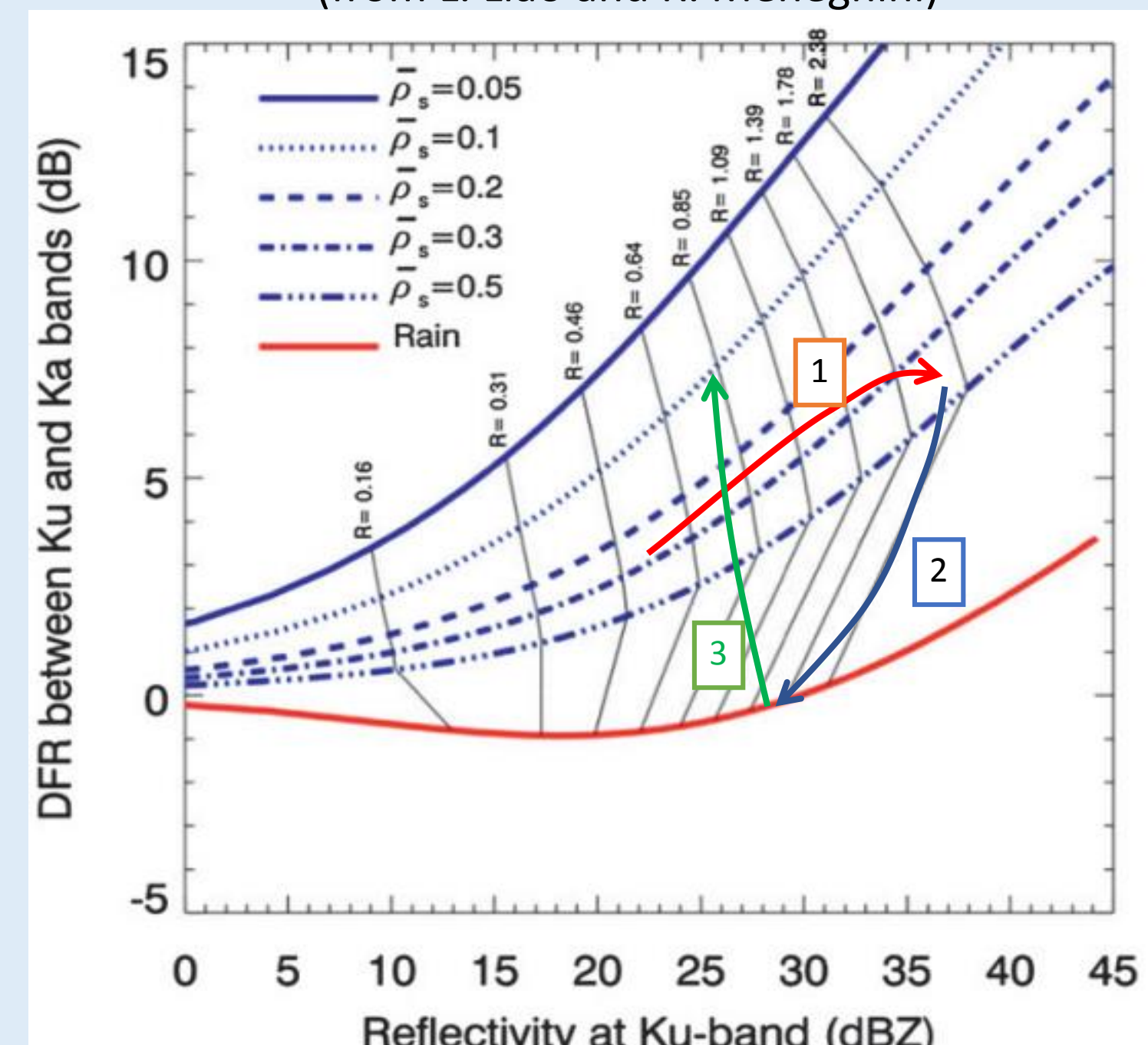
standard algorithm
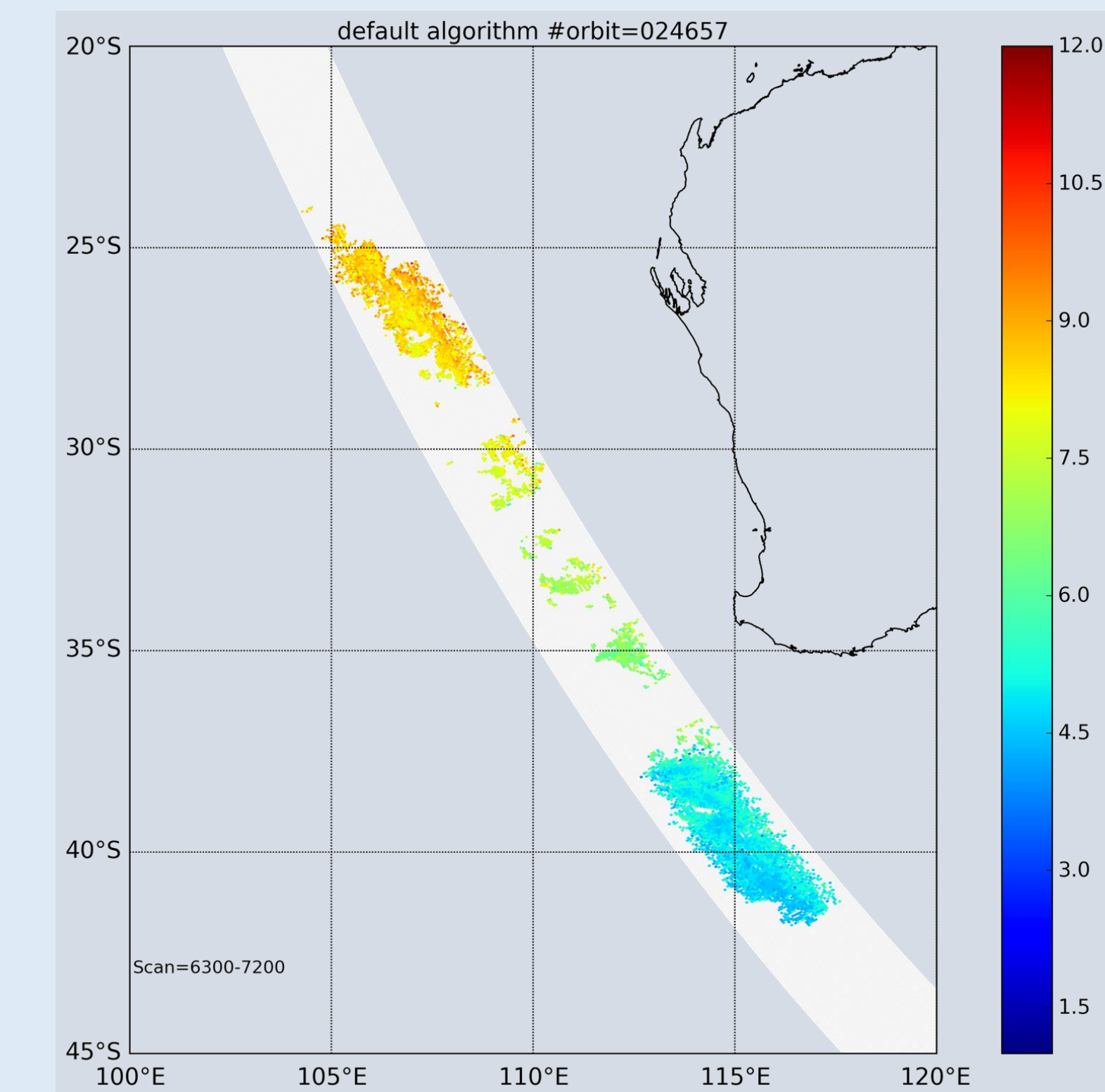
DFR method

Algorithm for identifying the melting top in stratiform precipitation

- DFR_m vs Z_m(Ku or Ka) plot as a function of range exhibits a loop around the melting layer in stratiform rain.
  - $DFR_m = Z_m(Ku) - Z_m(Ka)$
- The loop is made because the peak of DFR_m and that of Z_e appear at different ranges.
  - The DFR_m peak appears at a slightly higher altitude than the Z_m peak.
- The algorithm uses only the first derivatives of DFR_m and Z_m as major factors.
  - Approximate temperature is used to set the search window.
  - A very simple attenuation correction of HB type is used. (Att. correction is necessary only for relatively intense rain cases.)
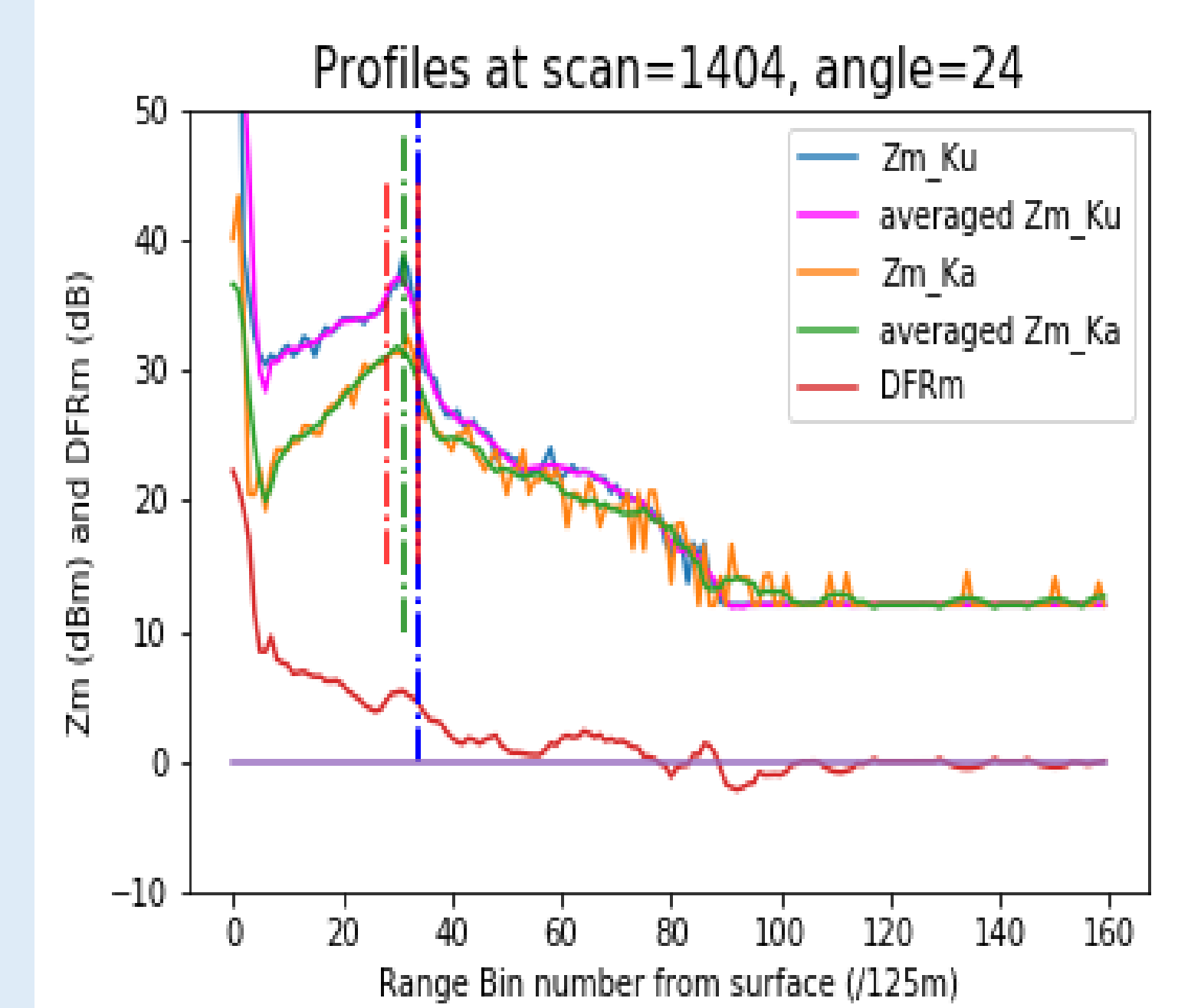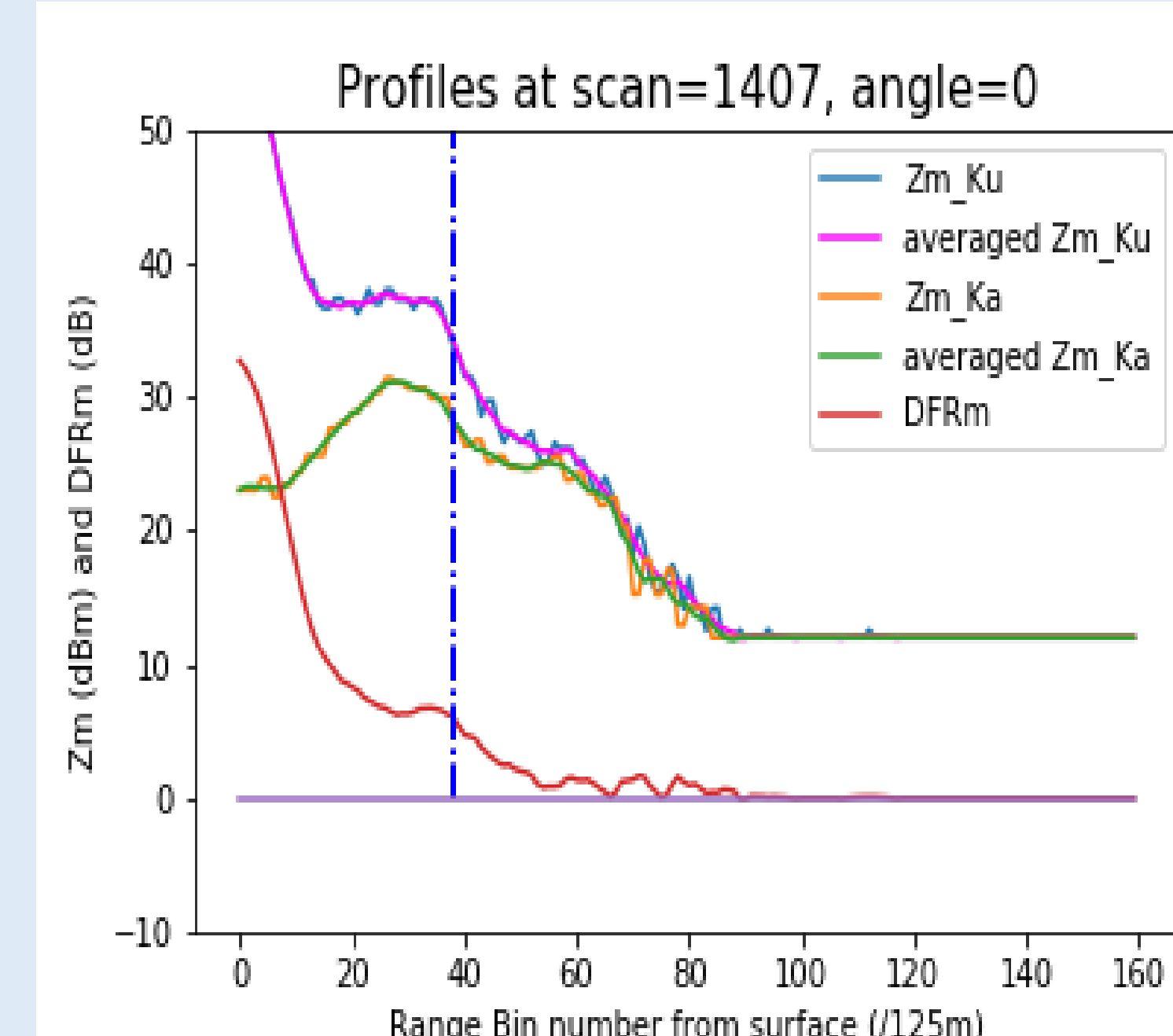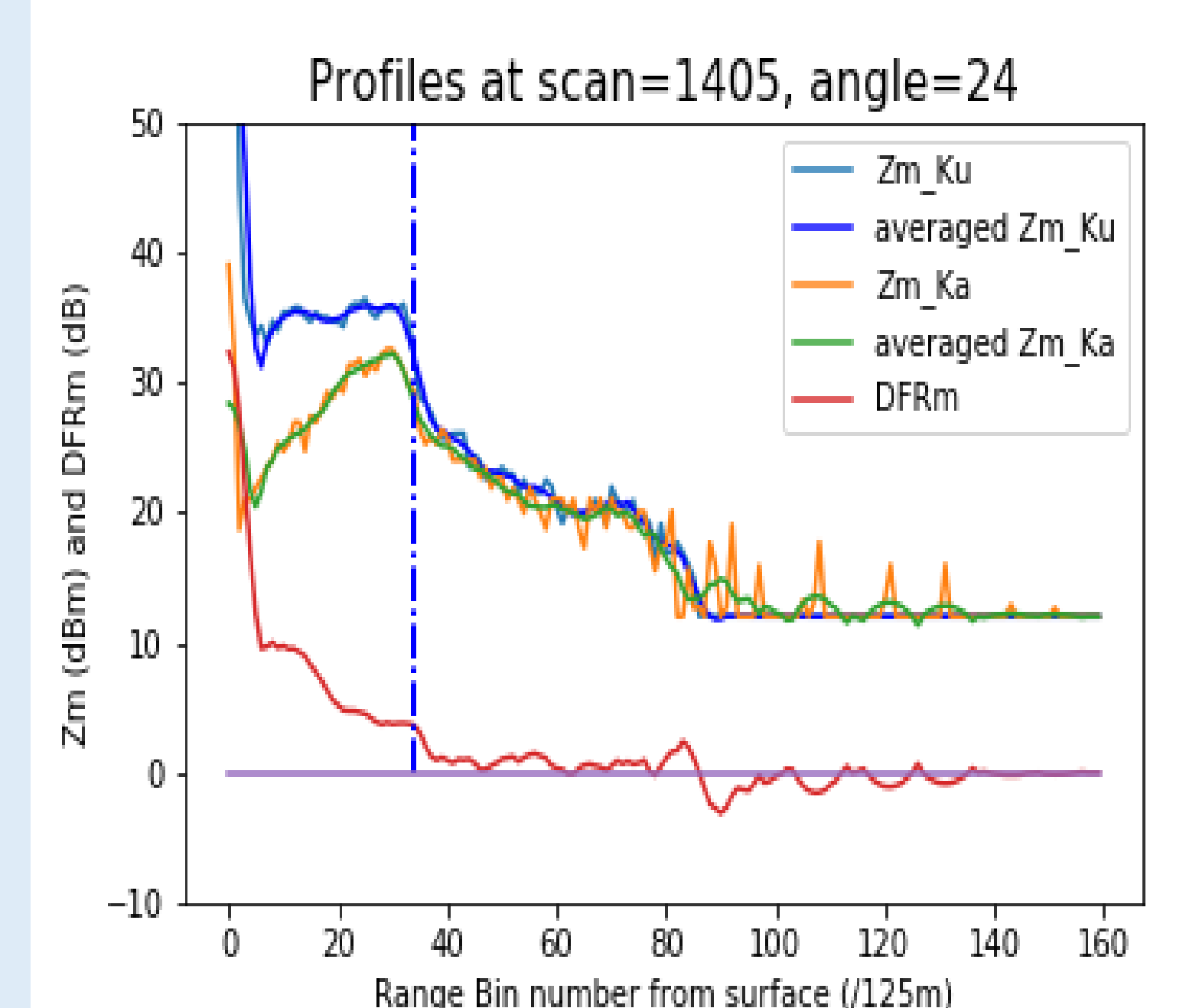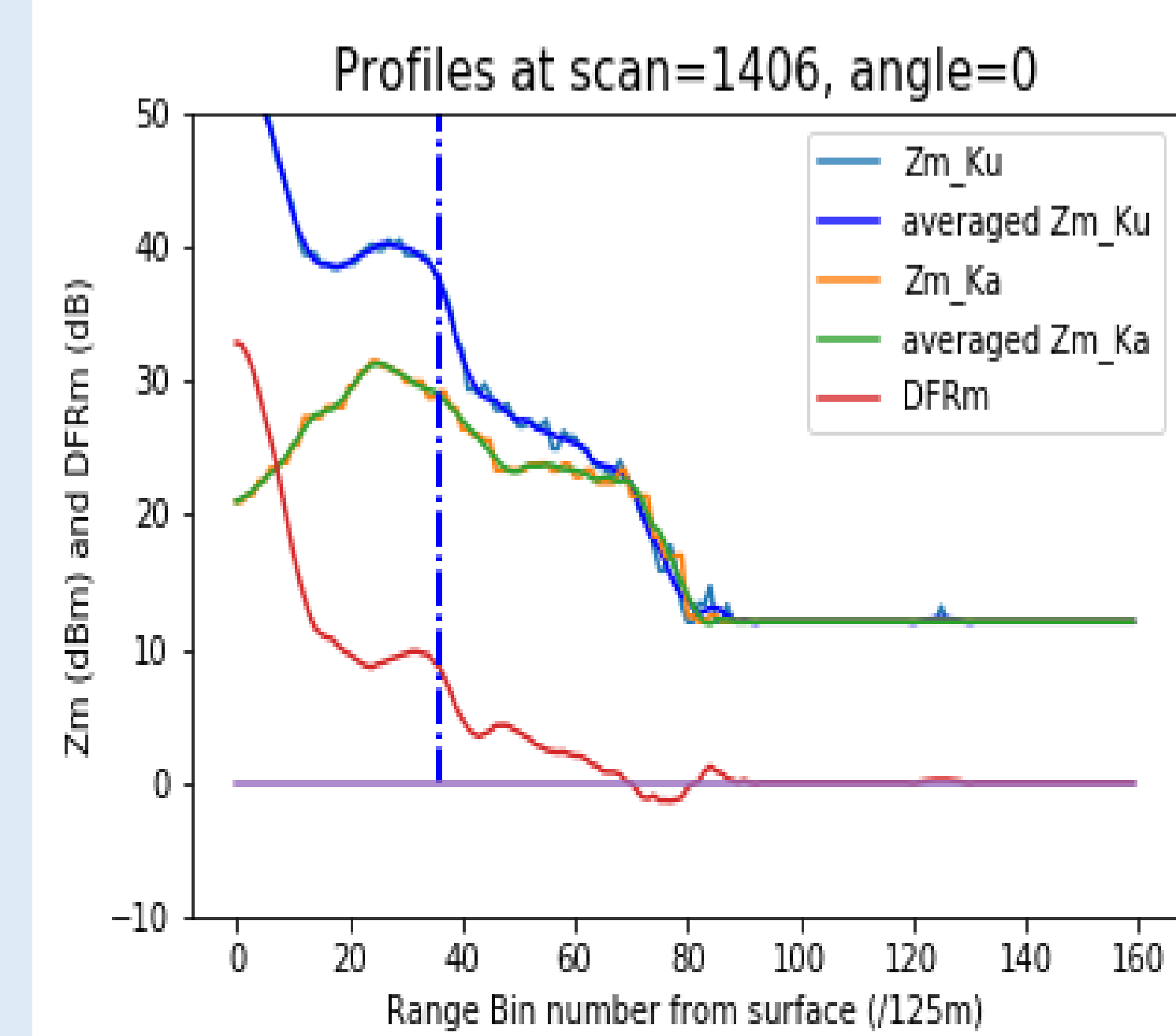
Example of DFR_m-Z_m trajectories
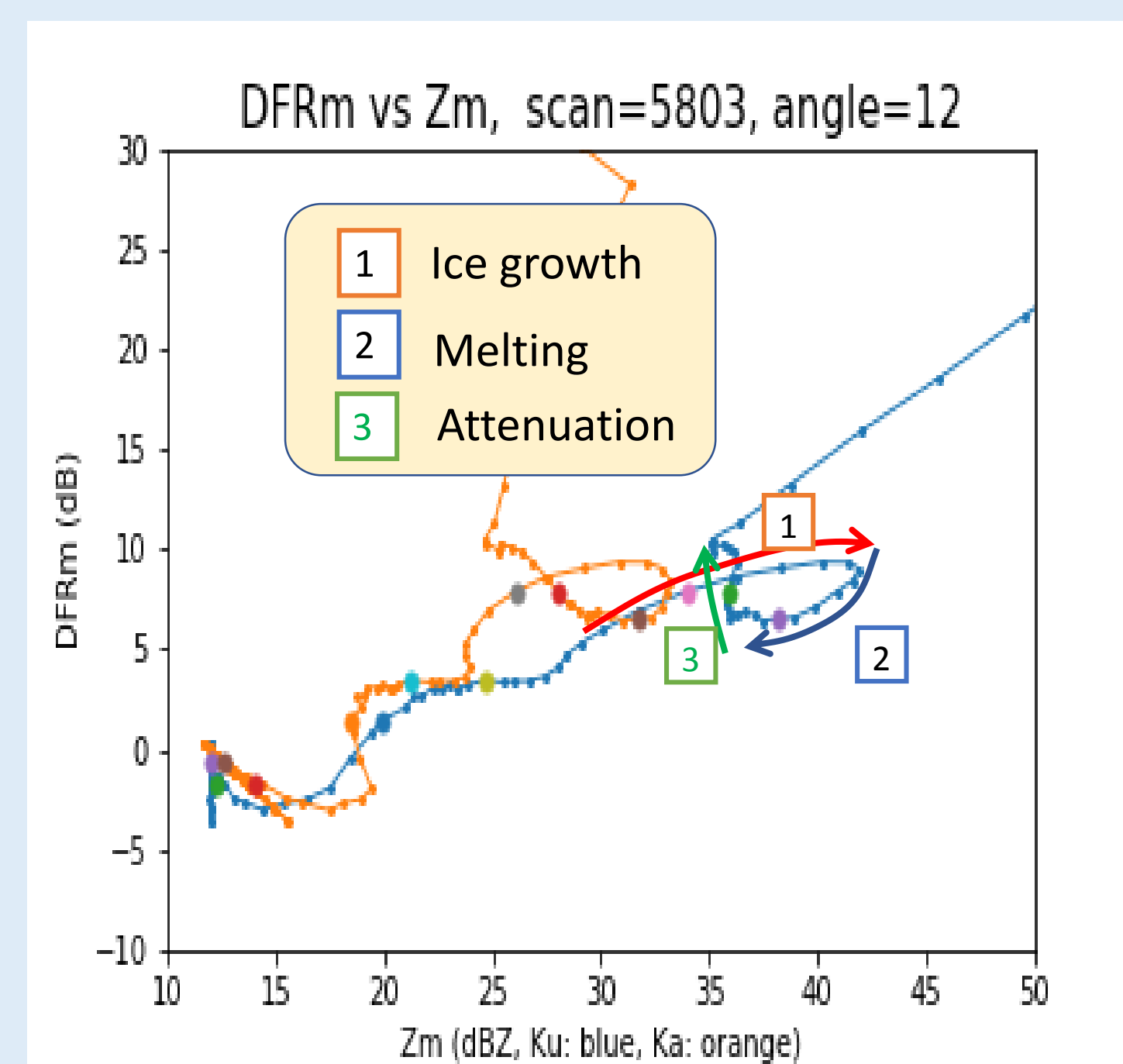
DFR-Z_m(Ku) relation
(from L. Liao and R. Meneghini)

DFRm vs Zm, scan=5803, angle=12
1. Ice growth
2. Melting
3. Attenuation

Examples of melting layer detection

swath center

swath edge

Profiles at scan=1404, angle=24

Profiles at scan=1406, angle=0
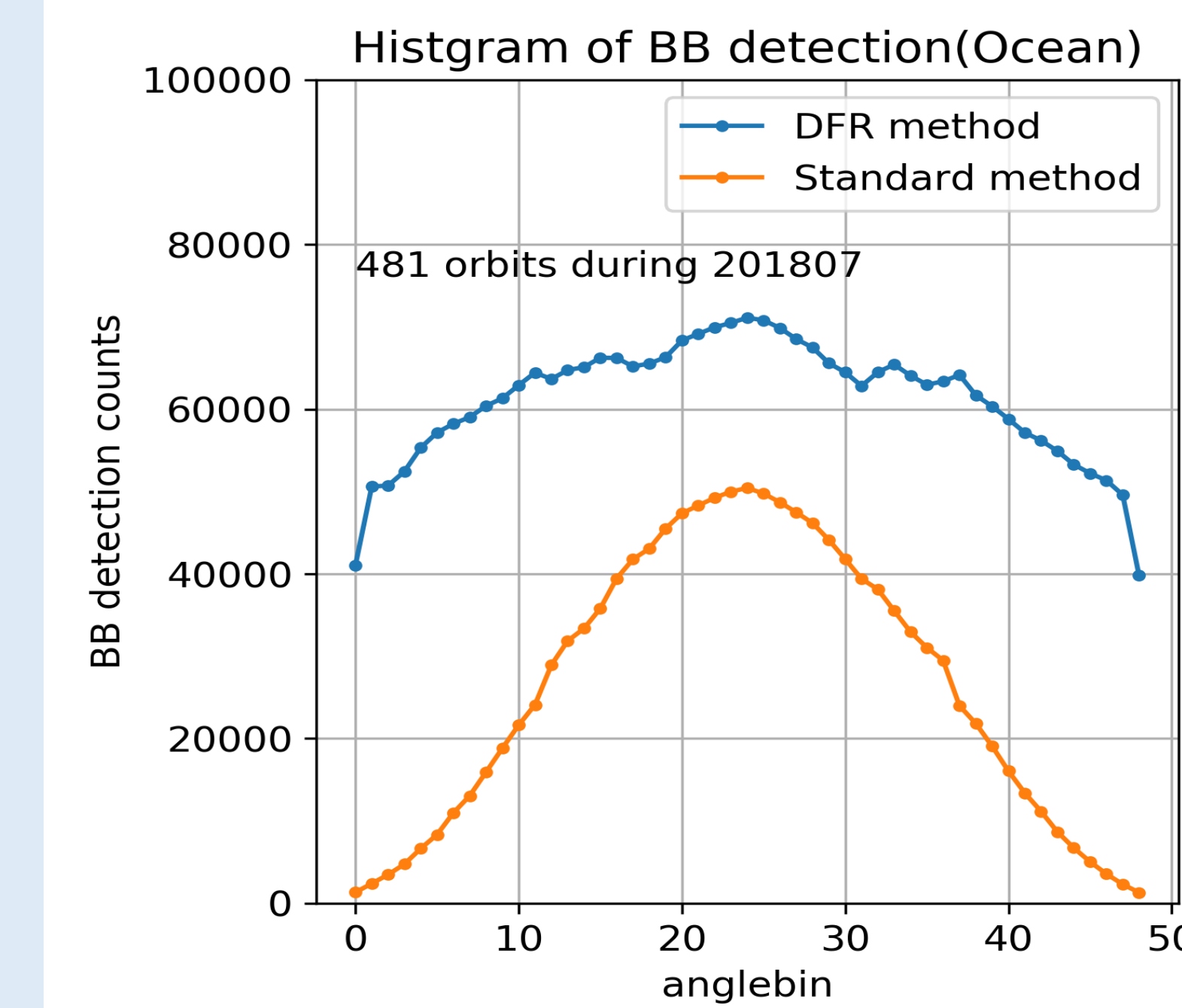
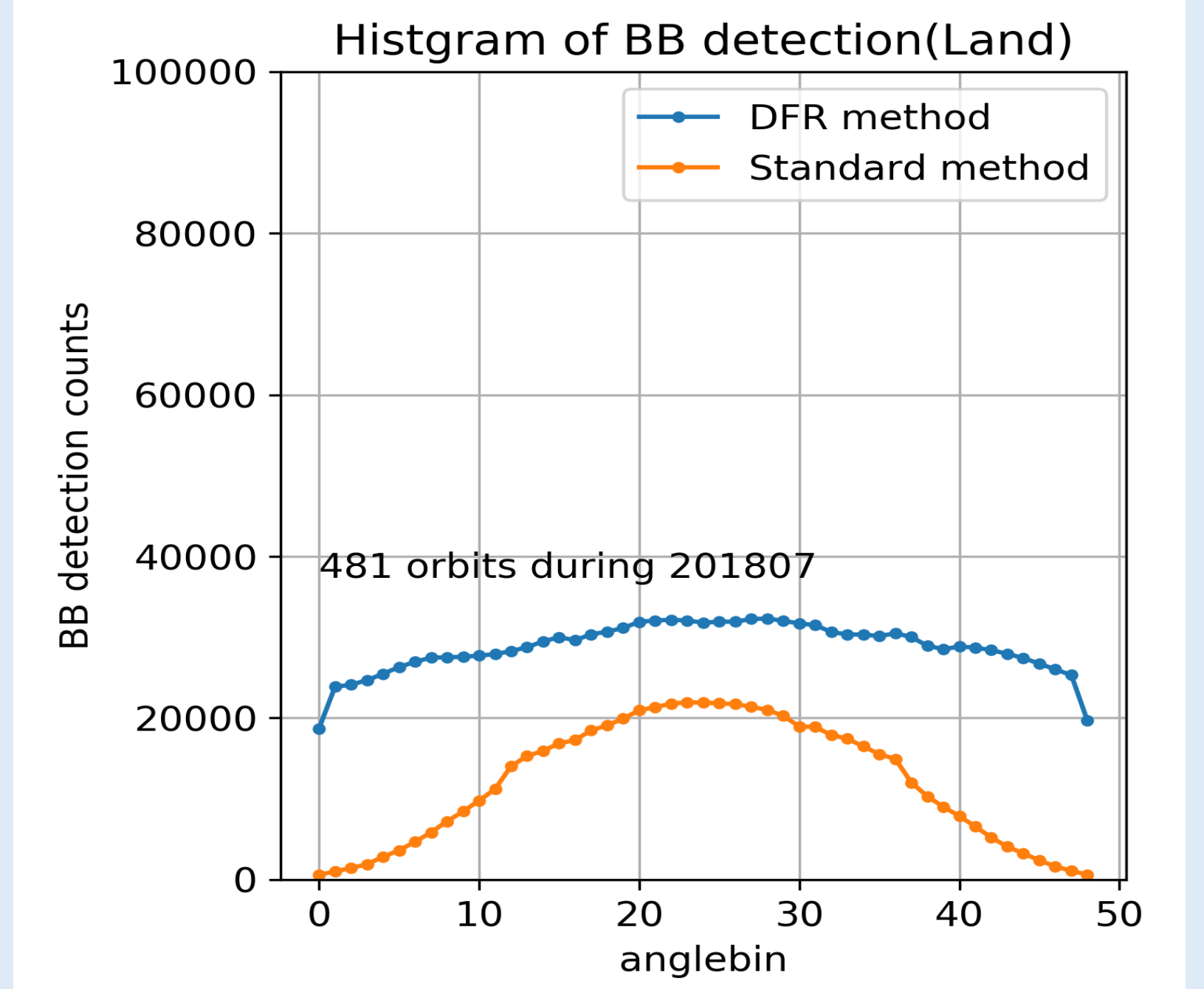Profiles at scan=1405, angle=24

Profiles at scan=1407, angle=0

Melting layer top by DFR method
Bright-band center by standard method
BB top and bottom by standard method

Detectability of a melting layer

Ocean

Land

Histgram of BB detection(Ocean) — 481 orbits during 201807

Histgram of BB detection(Land) — 481 orbits during 201807

Summary

- DFR method identifies the existence of a melting layer in a stratiform storm even when the melting layer does not exhibit a clear bright band because of the smearing effect due to slant measurement.
- DFR method increases the detectability of a melting layer substantially, in particular near scan edges.
- Identification of the melting or freezing height in a convective storm is a future issue.